UNITED STATES DISTRICT COURT FOR THE
SOUTHERN DISTRICT OF ILLINOIS

UNITED STATES OF AMERICA, Plaintiff, v APEX OIL COMPANY, INC., Defendant.	Case Number: 05-CV-242 DRH CJRA Track: C Hon. David R. Herndon

UNITED STATES' RENEWED MOTION TO STRIKE
TESTIMONY OF ERIC L. BUTLER

Pursuant to Federal Rule of Evidence 702, Plaintiff United States moves to strike the Expert Report of Eric L. Butler, Ph.D., Defendant's Trial Exhibit No. 586, and Dr. Butler's trial testimony relating thereto.[1/] The speculative conclusions that constitute Dr. Butler's opinions are unreliable because the methodology he employs cannot be tested or independently assessed and has not been appropriately applied to the facts in this matter. Dr. Butler's report and associated trial testimony are superficial, at best, and constitute "junk science" of the type the District Court is charged with excluding under Rule 702 and Daubert v. Merrill Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993). In the alternative, Dr. Butler's testimony and report should be found unreliable and assigned little, if any, weight.[2/] See Elliot v. Commodities Futures Trading Co., 202 F.3d 926, 934 (7th Cir. 2000). The United States' *Renewed Motion to Strike* should be granted.

Standard of Proof

The admissibility of expert evidence is governed by Federal Rule of Evidence 702, which states:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in

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[1/] On August 11, 2006, the United States filed a *Motion to Strike the Testimony of Eric L. Butler* (Doc 82), which was denied on March 15, 2007 (Doc. 91). Following the examination of Dr. Butler at trial, the Court invited the United States to renew its motion. Trial Day 17 at 114.

[2/] In the Elliott case, the Seventh Circuit recognized that it may be harmless error to admit expert opinions that should have been excluded under Daubert if it is clear that the factfinder "assign[ed] the unreliable testimony little if any weight." Elliot v. Commodities Futures Trading Co., 202 F.3d 926, 934 (7th Cir. 2000). As the Court of Appeals explained, "Daubert and Kumho were decided in the context of admissibility, but the principle for which they stand – that all expert testimony must be reliable – should apply with equal force to the weight that a factfinder accords expert testimony." Id. Thus, in a case like this where "effective cross-examination of [an expert] exposed his opinion – and therefore his ultimate conclusion – as unreliable," a judge who is acting as the factfinder should at least "ignore[] [an expert's] unreliable opinion and draw[] [his] own inferences from the undisputed facts," even if the expert's testimony is not formally excluded under Rule 702. Id.

> issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Fed. R. Evid. 702. In Daubert, the Supreme Court charged trial judges with the role of "gatekeeper" with regard to expert testimony, asserting a duty to "ensure that any and all scientific testimony or evidence admitted is not only relevant but reliable." 509 U.S. at 589.

Once a witness has been qualified as an expert in the relevant field, the party proffering the expert must show that the expert's proposed opinions are reliable. See Smith v. Ford Motor Co., 215 F.3d 713, 718 (7th Cir. 2000); Caraker v. Sandoz Pharm. Corp., 188 F. Supp. 2d 1026, 1030 (S.D. Ill. 2001). As Judge Gilbert noted, the "hallmark of this reliability prong is the scientific method, *i.e.*, the generation of testable hypotheses that are then subjected to the real world crucible of experimentation, falsification/validation, and replication." Caraker, 188 F. Supp. 2d 1026, 1030; see also O'Conner v. Commonwealth Edison Co., 13 F.3d 1090, 1106 (7th Cir. 1994) (district court must consider whether testimony has been subjected to scientific method).

The Court in Daubert provided a non-exclusive list of factors for use in assessing the reliability of proffered "expert" opinion testimony, including:

(1) whether the proffered theory can be and has been tested;

(2) whether the theory has been subjected to peer review;

(3) whether the theory has been evaluated in light of potential rates of error; and

(4) whether the theory has been accepted in the relevant scientific community.

See Dhillon v. Crown Controls Corp., 269 F.3d 865, 869 (7th Cir. 2001), citing Daubert 509 U.S.

at 593-94.

Additionally, in order to assist the fact-finder in understanding the evidence, a proffered opinion must "fit" *(i.e.,* have a valid scientific connection to) the issues in the lawsuit. See O'Conner, 13 F.3d at 1106; Caraker, 188 F. Supp. 2d at 1030. This second prong "is not satisfied when there is simply too great an analytical gap between the data and the opinion proffered." Caraker, 188 F. Supp. 2d at 1030, quoting General Elec. Co. v. Joiner, 522 U.S. 136, 138 (1997). As discussed in detail below, Dr. Butler's opinions are not grounded on reliable scientific methodology and do not "fit" the facts of this case. The United States' *Renewed Motion to Strike* should be granted.

NAPL and Vapor-Phase Hydrocarbons

Dr. Butler's opinions relate to the source of vapor-phase hydrocarbons in near surface soils and indoor air. At trial, Dr. Butler concurred with the relevant, underlying physical concepts regarding the generation and behavior of vapor-phase hydrocarbons as set forth herein. Petroleum products are light non-aqueous phase liquid hydrocarbons ("LNAPL" or "NAPL"). Butler Test. Day 12 at 49. Liquid or "free-phase" NAPL is currently present on top of the groundwater beneath much of the northern portion of Hartford, Illinois. Butler Test. Day 13 at 11. Free-phase hydrocarbons volatilize into vapor-phase hydrocarbons. Id. at 20.

Vapor-phase hydrocarbons migrate from source areas due to diffusion and advection. Diffusion is the process of molecular movement by which components of vapors move from areas of higher concentration to areas of lower concentration. Id. at 21-22. Advection is the process by which vapors are pushed from areas of high/positive pressure to areas of low/negative pressure. Id. at 22. The pressure differentials that cause advection may be due to atmospheric conditions (*e.g.* movement of a storm system) or man-made conditions, such as the use of pumps

or fans. Id. at 22-23. As groundwater levels rise, vapor-phase hydrocarbons generated by the NAPL atop the groundwater will be displaced and pushed along preferential pathways toward the surface, if such pathways are present. Id. at 23, 25. Vapors existing above the displaced vapors will mix with, and likewise be displaced by, the rising vapor-phase hydrocarbons. Id. at 25.

Dr. Butler's Expert Report and Trial Testimony

As required by Federal Rule of Civil Procedure 26(a)(2)(B), the expert opinions of Dr. Butler were disclosed to the United States in the *Expert Report of Eric Butler Ph.D.* dated May 15, 2006 ("Report") and submitted to the Court as Defendant's Exhibit No. 586. Eric Butler has a Ph.D. in chemical oceanography from the University of Rhode Island, but has not utilized his oceanography expertise for a number of years. Butler Test. Day 13 at 7. The Report consists of an "overall opinion" (Opinion 1) supported by seven sub-opinions, of which Dr. Butler conceded at deposition four (Opinions 3-6) were of primary importance. Butler Test. Day 12 at 152; Butler Dep. at 257.[3/]

Dr. Butler's overall opinion is as follows:

> The NAPL on the groundwater table under Hartford Illinois is not causing odor problems in indoor air in Hartford, nor causing or contributing to (in any meaningful way) dangerous levels of hydrocarbon vapors in the shallow soil gas of Hartford.[4/]

Def. Ex. 586 at 2. As discussed in detail below, the sub-opinions set forth as support for the

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[3/] A complete copy of the 2006 deposition of Eric Butler was attached to the United States' initial *Motion to Strike* (Doc. 72; Attach. 1-4).

[4/] Dr. Butler's Report characterizes the concentrations of vapor-phase hydrocarbons in near surface soils as "dangerous levels of hydrocarbon vapors" and he reiterated this characterization at his deposition. Def. Ex. 586 at 2; Butler Dep. at 250. At trial, however, Dr. Butler testified that he now preferred to describe near surface vapor-phase concentrations as simply "elevated." Butler Test. Day 13 at 167.

overall opinion are in and of themselves insufficient to satisfy the requirements of Rule 702 and Daubert. Opinion 1 and the allegedly supporting sub-opinions on which it rests should be struck.

1. Opinions 4 and 5, Comparing the Composition of Vapors Associated with Free-Phase NAPL and Samples Collected in the Community Center and East Watkins Street Residences, are Not the Product of Reliable Principles and Methods.

Dr. Butler's Opinions 4 and 5 are based on the proposition that if free-phase NAPL is the source of vapor-phase hydrocarbons found in sub-slab and indoor air samples, then the ratios of the chemical constituents in the sub-slab and indoor air samples should correspond in some unspecified way to the ratios of those chemical constituents in the vapors immediately above the free-phase NAPL. Dr. Butler acknowledged that the ratio of the constituent compounds in vapor-phase hydrocarbons can change as the vapors migrate in the sub-surface. Butler Test. Day 13 at 135. Because Dr. Butler did not use a reference standard, a known benchmark for how the ratios of vapor-phase hydrocarbon constituents change as they travel from the free-phase NAPL up to the near-surface, we are left with nothing more than Dr. Butler's "expert intuition" as the basis for his opinion that the ratios are too different for the free-phase NAPL to be the source. Dr. Butler, however, has never performed a similar analysis with vapors and indeed has virtually no experience in the forensic analysis of vapor-phase hydrocarbons.

Prior to this matter, Dr. Butler had performed a forensic analysis of hydrocarbon vapors on only one occasion. Butler Test. Day 13 at 131. That analysis was limited to an evaluation of vapor samples collected in near surface soils, from probes located approximately two to three feet below ground. Id. at 132. That matter did not include an effort to distinguish between vapor-phase hydrocarbons present at varying depths below ground. Id. at 132-33. Dr. Butler had never before conducted a constituent ratio analysis for vapor-phase hydrocarbons and he had

never tried to compare constituent concentrations that had been normalized to butane, as he did here. Id. at 133. Dr. Butler simply lacks sufficient practical experience in measuring, anticipating, and assessing changes in hydrocarbon vapors as they pass through the subsurface to render an opinion that is not substantiated by use of a reference standard. Dr. Butler's expert intuition is insufficient to satisfy the requirement of reliability imposed by Rule 702 and Daubert and, therefore, Opinions 4 and 5 should be struck.

Dr. Butler's ratio analysis opinions are unreliable because his "theory" has not and cannot be tested; it fails to identify what ratios of constituent compounds would identify or disqualify free-phase NAPL as the vapor source. As noted by Dr. Andrew Nicholson, "the important thing with ratios is making sure there is an appropriate context around the ratios" -- one must establish a reference data set (*i.e.* a range of possible outcomes) to compare the ratios to. See Nicholson Test. Day 9 at 18-19. Thus, when Dr. Nicholson used ratio comparisons for his hydrocarbon "fingerprint" analysis, he first compiled reference standards from published literature setting forth the ***known ratios*** of different trimetheylpentane ("TMP") isomers found in gasoline containing alkylate produced using a hydrofluoric acid alkylation process and that produced using a sulfuric acid alkylation process.[5/] Id. With this information in hand, Dr. Nicholson could take a NAPL sample from beneath the Village, identify its ratio of TMP isomers, and compare that ratio against the known TMP ratios for hydrofluoric acid and sulfuric acid alkylation processes to determine which standard was a match for the Hartford sample.

Dr. Butler, however, did not identify or develop a reference standard for the expected

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[5/] Many of these reference standards were taken from the work of Professor Lyle Albright who both collected published reference standards and developed reference standards from Hartford field data. See Pl. Ex. 24 at APEXDEPO_002070-071; Pl. Ex. 167 at APEXDEPO_001059.

alteration in the constituent compounds of vapor-phase hydrocarbons as they migrate through the subsurface. Butler Test. Day 13 at 140. Among the factors that can alter constituent ratios are whether the vapors come into contact with organic material and/or water. Id. at 137-138; see also Nicholson Test. Day 8 at 199. Without a reference standard, the Court was left with nothing more than Dr. Butler's inexperienced "professional judgment" for his opinion that the ratio of constituents in the indoor air / sub-slab samples are "too different" from the ratios of the vapors just above the free-phase NAPL for the free-phase NAPL to be their source.

The insufficiency of Dr. Butler's analysis and its unreliability are readily apparent from his two examples. Dr. Butler tried to analyze the Hartford Community Center sub-slab data and East Watkins Street indoor air data by converting measured vapor constituent concentrations from micrograms per meter cubed (ug/m3) and parts per billion volume (ppbv), respectively, to moles per liter (moles/L), and then normalizing the constituents to butane to identify the "constituent to butane" ratio. Butler Test. Day 12 at 114-115, 141-142. He then drew conclusions based on a subjective comparison of these ratios with theoretical vapor ratios calculated from free-phase NAPL samples taken from "nearby" monitoring wells.

In Opinion 5, Dr. Butler compared constituent ratios from indoor air samples collected during the May 2002 East Watkins Street vapor intrusion events against vapor constituents calculated from a liquid NAPL sample collected at monitoring point 60 ("MP-60") in January 2005.[6] Butler Test. Day 12 at 115-116. Dr. Butler concluded that the free-phase NAPL was not the source of the East Watkins Street vapors, because the butane-normalized ratios for 1-pentane,

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[6] MP-60 is located approximately 240 feet away from the nearest home used by Dr. Butler, 134 East Watkins, and approximately 450 feet from the furthest, 116 East Watkins. Butler Test. Day 13, at 144-145.

isopentane, hexane, and isohexane were greater (more "enriched") in the indoor air samples than in the vapors immediately above the free-phase NAPL. Butler Test. Day 12 at 117-118.

Dr. Butler, however, fails to provide a reference standard -- or indeed any basis whatsoever -- indicating why the fact that supposed enrichment in the indoor air samples proves that the vapors did not emanate from the free-phase NAPL. Because his ratio interpretation theory is not based on prior testing or literature, Dr. Butler has no basis for ruling out the possibility that the enrichment is simply a byproduct of the vapors migrating through the subsurface soils. Application of Dr. Butler's methodology to data from actual vapor samples collected from varying depths at MP-58, located closer to most of the homes than MP-60, indicates that vapors in the vicinity of the East Watkins Street homes become enriched in isopentane as they migrate upward from the subsurface.[7] See Attach. 1. Likewise, Dr. Butler's unsupported theory does not rule out the possibility that any observed enrichment is simply a function of distance from the NAPL sample location, as the ratio of each compound to butane is greater the further the home is from MP-60.[8]

Even if the Court accepted Dr. Butler's methodology, his "finding" that the differences between the constituent ratios in the East Watkins Street indoor air samples and those derived from the NAPL sample collected at MP-60 indicate that the NAPL is not the source of the East Watkins Street vapors does not "fit" with his conclusion that the NAPL is unrelated to vapor-

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[7] Attachment 1 is a corrected version of Plaintiff's Demonstrative Exhibit 627, which was discussed during Dr. Butler's cross-examination, but not offered into evidence. The data on Attachment 1 is taken from Plaintiff's Exhibit Nos. 177 and 197, which were admitted into evidence and available to Dr. Butler at the time he prepared his report.

[8] For example, the ratios of isopentane to butane moving away from MP-60 are approximately 2.4 to 1 (134 E. Watkins), 2.6 to 1 (130 E. Watkins), 3.7 to 1 (120 E. Watkins), and 4.2 to 1 (116 E. Watkins). Def. Ex. 1119.

phase hydrocarbons in near-surface soils. Unlike most of the affected homes in North Hartford, the East Watkins Street homes do not lie above any accumulation of free-phase NAPL -- only ***residual-phase*** hydrocarbons are present beneath those homes. Butler Test. Day 12 at 115; Butler Test. Day 13 at 154. Indeed, both gasoline-range and heavier-range residual-phase hydrocarbons are present beneath the relevant portion of East Watkins Street at different depths. Pl. Ex. 199 at EPA_RPT026243.

The free-phase NAPL sample used by Dr. Butler was collected hundreds of feet away from the homes on East Watkins Street. While vapors volatilizing from the free-phase NAPL at MP-60 could theoretically migrate beneath the East Watkins Street homes, it is unlikely that such vapors would be the sole source of the vapors impacting those homes, because the residual-phase contamination directly beneath the East Watkins Street residences is also volatilizing. Such residual-phase hydrocarbon contamination would have been impacted by "water-washing" over time, resulting in it being enriched in isopentane as to butane -- as was found in the indoor air samples.[9] See Butler Test. Day 13 at 154-155. Dr. Butler testified that as vapor-phase hydrocarbons volatilize from the free-phase NAPL, those vapors will displace and mix with vapor-phase hydrocarbons present in the geological strata above it. Id. at 25. His comparative ratio analysis, however, fails to account in any way for the impact of vapors generated by residual-phase hydrocarbons on vapors volatilizing from the NAPL pool.[10] Id. at 148-149.

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[9] "Water-washing" occurs when hydrocarbons come in contact with rising groundwater or infiltrating precipitation. As butane is more soluble in water than isopentane, water-washing alters the ratio of isopentane to butane, leaving the "washed" product more enriched in isopentane. See Butler Test. Day 13 at 154-155; Nicholson Test. Day 9 at 6-7.

[10] Thus, at most Dr. Butler has shown that vapors generated from free-phase NAPL hundreds of feet northeast of the East Watkins Street homes were not the ***sole*** source of the May 2002 vapor intrusions, but in light of the significant residual-phase hydrocarbon contamination present directly beneath those homes

In Opinion 4, Dr. Butler compares constituent ratios in vapor concentrations derived from free-phase NAPL collected from wells near (and not so near) the Hartford Community Center with vapor samples collected between December 2004 and March 2005 from sub-slab monitoring points located beneath four rooms in the Community Center.[11/] Again he concluded that the constituent ratios from the NAPL differ too greatly from the sub-slab vapors for the NAPL to be the source of such vapors.

Review of the sub-slab data, however, shows that the sub-slab vapor constituent ratios vary widely by both location and date. For example, the ratio of isopentane to butane in samples collected from beneath different rooms on the same date, December 28, 2004, were 4.8 to 1 in the Sub-Slab Cafeteria Closet sample and 1,115.6 to 1 in the Sub-Slab Boiler Room sample. Similarly, looking only at samples collected from beneath the Boiler Room, isopentane to butane ratios ranged from a low of 1.4 to 1 on January 25, 2005 to a high of 2,197.3 to 1 on March 31, 2005, along with a wide variety of other levels as the ratios fluctuated week to week. See. Pl. Demo. Ex. 626. That variability exposes fundamental flaws in Dr. Butler's self-conceived "test" of the source of the vapors. If the methodology yields such divergent results in nearby sampling locations (on the same day) and from week to week (at the same location) than the "test" itself is invalid. Dr. Butler's simplistic ratio analysis does not adequately address the complexity of the Hartford site geology and contamination pattern.

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there is no reason to think the free-phase NAPL would have been the ***sole*** source.

[11/] Dr. Butler's report included a subset of the sample data set forth in ENSR Corporation's *Technical Memorandum: Hartford Community Center Sampling and Soil Vapor Extraction System Operation* (Plaintiff's Exhibit No. 187). He included samples collected from beneath the boiler room on 18 dates, the evidence hallway on six dates, the cafeteria closet on four dates, and the hallway on two dates. Def. Ex. 586 at Table 4b.

Distilled to their essence, Dr. Butler's opinions are nothing more than unsupported assertions that the vapor ratios are too different. In performing its obligation as gatekeeper for reliable expert testimony, the district court is "not required to simply 'tak[e] the expert's word for it.'" Caraker, 188 F. Supp. 2d at 1030, quoting Advisory Comm. Notes to 2000 Amendments to Rule 702. Opinions 4 and 5 should be struck as unreliable.

2. Opinion 3, Comparing Odor Complaints / Fires with Groundwater / Rainwater Levels, is Not the Product of Reliable Principles and Methods.

In Opinion 3, Dr. Butler states that the "[e]valuation of groundwater and weather event data shows that the NAPL pool on the groundwater table is not related to odor complaints and fires." Def. Ex. 586 at 4-6. To formulate this opinion, Dr. Butler simply compiled and plotted certain data on historic odor complaints / fires and groundwater / rainfall levels. He did not (and probably could not) confirm that those historical data sets were accurate and complete and his data set comparison included no formal statistical analysis to ascertain correlation coefficients among the data. Rather, Dr. Butler simply identified that there was no "direct correlation" between groundwater / rainfall levels and the number of odor complaints / fires and then concluded that free-phase NAPL is unrelated to such complaints. Opinion 3 must be struck because Dr. Butler has applied an unreliable methodology using insufficient data.

Although Dr. Butler claims he is debunking prior analyses linking odor complaints and fires to groundwater/rainfall levels, in actuality he is merely knocking down a strawman. The prior analyses focused on the effect of ***rising*** groundwater, not groundwater levels *per se*. The primary historic source for this linkage is the 1978 report issued by John Mathes & Associates, on behalf of Clark Oil among others, entitled *Phase I, Gas Odors & Fires, Hartford, Illinois* ("Mathes Report"). See Def. Exs. 242 and 242A. In that report, Mr. Mathes plotted odor

complaints against a hydrograph depicting monthly groundwater levels for the period from 1966 through 1978. Def. Ex. 242A at 5. Assessing the data, Mr. Mathes concluded that "the ***upward movement*** of the groundwater level appears to be closely related to reports of gas odors." Def. Ex. 242 at 22 (emphasis added). He noted that complaints of gas odors generally occurred when the groundwater level began to rise. Id. at 21 Mr. Mathes further found that while occasionally, complaints were received when the groundwater level was already high but falling, such complaints generally followed periods of heavy rain.[12/] In 1992, Engineering Science, Inc. extended Mr. Mathes' analysis for the period through 1990, plotting odor complaints and fires against groundwater levels for the period 1961 through 1990, and found that the additional data likewise supported the Mathes Report's conclusions regarding the relationship between *rising* groundwater and odor complaints / fires. See Pl. Ex. 164 at APEX000808-809.

Dr. Butler generated hydrographs illustrating groundwater levels in Hartford for the period 1990 through 1995, against which he plotted odor complaints / fires.[13/] This data is consistent with the Mathes conclusions. With regard to the years 1990 and 1993, highlighted by Dr. Butler with individual figures, every odor and fire complaint occurred on a date when groundwater levels were rising.[14/] Butler Test. Day 13 at 48, 53; Def. Ex. 586 at Figs. 5-6.

Dr. Butler also separately plotted the odor complaint / fire data against graphs of

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[12/] Mr. Mathes also acknowledged that groundwater levels could have been actually rising on such dates, but that the monthly readings used to develop the hydrograph might not have captured the fluctuation in the groundwater level. See Def. Ex. 242 at 22.

[13/] Dr. Butler also had groundwater data for the years 1978, 1996, and 2003, but chose not to graph those years.

[14/] Dr. Butler concurred that as the two odor complaints in August and November 1990 were from homes south of Hawthorne Avenue, they were not related to complaints due to the hydrocarbon plume beneath North Hartford. Butler Test. Day 13 at 48-50.

maximum daily precipitation by week for the period from 1970 through 2005. Def. Ex. 586 at Figs. 12-17. These figures again support Mathes' conclusions. For example, the May 2002 odor complaints occurred during a period of heavy rainfall. Def. Ex. 586 at Fig. 17. Dr. Butler provided separate groundwater and precipitation figures for 1990. Def. Ex. 586 at Figs. 5 and 15. When the two figures are overlaid, the relationship between odor complaints / fires and groundwater/rainfall is readily apparent: each of the odor complaints / fires occurred while groundwater levels were rising, with the largest grouping of complaints occurring during periods of heavy rain in May 1990. Pl. Demo. Ex. 608.

Unlike Mathes and ESI, who drew their opinions from the presence of facts -- odor complaints / fires were reported when groundwater levels were rising -- Dr. Butler's opinion is based on the absence of facts, *i.e.* the lack of a "consistent pattern" between odor complaints / fires and groundwater elevations and/or precipitation events. Dr. Butler's methodology is unreliable because he provides no scientific basis for his hypothesis that "[i]f odors and fires are caused by the combination of this NAPL pool and high groundwater levels, there should be a consistent pattern observed when comparing groundwater elevations to the occurrence of odor complaints and fires." Def. Ex. 586 at 4; Butler Dep. at 64. Dr. Butler does not cite any literature as to why a "consistent pattern" should be expected between these factors if free-phase NAPL were the source. Butler Dep. at 58.

Moreover, Dr. Butler's assumption that there should be a direct correlation between groundwater level and the number of odor complaints / fires fails to take into account a wide array of known factors that conflict with such an assumption. Dr. Butler believes the lack of complaints when groundwater elevations are elevated, *but falling*, supports his opinion (Butler Test. Day 12 at 81), despite acknowledging that it is *rising* groundwater that would push vapors

into homes (Butler Test. Day 13 at 23). Likewise, Dr. Butler's assumption of a direct correlation fails to take into account that a "tipping point" exits where rising groundwater has caused vapor intrusion and led to complaints, after which the vapor intrusion is addressed (ventilation of homes, etc.), and thus an increase in complaints might not be expected despite the continued rise in groundwater level.

To be admitted as an expert opinion, Dr. Butler's assumption that there should be a "consistent pattern" between complaints and groundwater/rainwater levels must first be established using reliable methodology. See Rosen v. Ciba-Geigy Corp., 78 F.3d 316, 319 (7th Cir. 1996) (an "insightful, even an inspired, hunch" lacks scientific rigor and is insufficient). Dr. Butler -- who has no background in statistics, econometrics, or any other related field that would qualify him to determine the appropriate correlation between complaints and groundwater/rainfall levels necessary to determine whether such complaints are related to free-phase NAPL (see Butler Dep. at 70) -- failed to perform any rigorous analysis of multiple, potentially confounding variables that might impact the relationship between odor/fire reports and groundwater/rainfall levels. No effort was made to identify the range of correlation coefficients (numerical values indicating how well dependent and independent variables track together) which would establish a relatively strong correlation between factors in the complex environmental system nor did he calculate such coefficients for the relevant factors.[15/]

[15/] After issuance of Dr. Butler's report, ENSR International issued a *Time Series Analysis and Statistical Evaluation of the Effects of Meteorological Phenomena on the Incidence of Reported Vapor Events*. Pl. Ex. 250 at EPA_RPT035114-199. Data reviewed by ENSR included daily averages for precipitation, temperature, barometric pressure, Mississippi River stage data, groundwater elevation data, and reports of odor complaints and fires. See Pl. Ex. 250 at EPA_RPT035114. Statistical analyses were performed using STATA, a statistical analysis software tool. Cross-correlation was also used to calculate correlation coefficients between data from one day and from preceding or following dates to identify lagging variables. Id. at EPA_RPT035118-119. ENSR recognized that "[d]ue to the complex nature of the data sets . . . demonstrating a great deal of natural variation in meteorological data and the relative

Dr. Butler has simply set forth a bald assertion that there should be a consistent pattern between complaints and groundwater/rainwater levels were free-phase NAPL related to such complaints. This is not sufficient.

> An expert must offer good reason to think that his approach produces an accurate estimate using professional methods, and this estimate must be testable. Someone else using the same data and methods must be able to replicate the result. Shapiro's method, "expert intuition," is neither normal among social scientists nor testable - and conclusions that are not falsifiable aren't worth much to either science or the judiciary.

Zenith Elec. Corp. v. WH-TV Broad. Corp., 395 F.3d 416, 419 (7th Cir. 2005). In Zenith, the Seventh Circuit rejected the proffered testimony where the witness had not "discussed statistical or econometric means" in generating his correlative conclusions. Id. Judge Easterbrook noted that "social science has tools to isolate the effects of multiple variables and determine how they influence one dependent variable . . . [p]erhaps the leading tool is multivariate regression . . . ." Id. Opinion 3 fails because Dr. Butler has failed to set forth a reliable, testable methodology. It does not satisfy the scientific method. It does not satisfy any of the hallmarks of reliability set forth in Daubert. Opinion 3 should be struck.

3. Opinion 6, Disqualifying Free-Phase NAPL as the Cause of the 1990 Odor Complaints, is Not the Product of Reliable Principles and Methods.

In Opinion 6, Dr. Butler opines that "[t]he NAPL pool on the water table was not responsible for the rash of odor complaints and fires in the spring of 1990." Def. Ex. 586 at 12.

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scarcity of vapor event reports, statistically strong correlations cannot reasonably be expected to arise from the data. However, given the non-linearity of the data and noise in certain data sets, correlation coefficients of 0.2 to 0.5 can be considered indicative of a strong degree of correlation." Id. at EPA_RPT035123. ENSR concluded from its statistical analysis that "[o]ver the long-term, river stage and prior day precipitation correlated best with reported vapor events." Id.

Between March and June 1990 there were 63 documented odor complaints / fires in North Hartford. Def. Ex. 586 at Table 2, p. 5-6. Dr. Butler's opinion disqualifying free-phase NAPL as the source of the spring 1990 incidents is based on the following: (i) there were "few odor/fire incidents in the years prior;" (ii) a Shell Oil pipeline leak occurred in December 1989 and gasoline was found in a sump at one of the affected sites, indicating a near-surface source; and (iii) "impermeable" clay layers separate the free-phase NAPL from area homes and "serve[] as an effective barrier to vapors over the NAPL pool." See id; Butler Test. Day 12 at 91-92.

On December 16, 1989, a leak occurred from an underground Shell Oil pipeline northeast of the intersection of Rand Avenue and North Olive Street ("Rand Avenue Leak").[16/] Dr. Butler opined that the leak was of sufficient magnitude that it formed a pool of gasoline on top of the ground surface which served as head pressure to force gasoline along subsurface areas of "facilitative transport" -- the fill surrounding the network of pipelines, utility lines, and sewers extending into North Hartford. Butler Test. Day 12 at 93-94. He also considered the presence of gasoline in a sump at 102 East Cherry Street following a March 21, 1990 fire at that location was "very important" to his opinion and that the source of that gasoline was "much more likely the cause of these odor and fire complaints . . . ." Butler Test. Day 12 at 95-96.

Dr. Butler, however, acknowledged at trial that he has no expertise or indeed understanding of the mechanics by which the Rand Avenue Leak could have migrated to the affected homes. When asked how the gasoline moved along the areas of "facilitative transport"

[16/] While the volume of the Rand Avenue Leak was initially estimated at 294,000 gallons, Shell Oil has informed Illinois EPA that it now believes the initial estimate overstated the amount actually released. See Butler Test. Day 13 at 77-78; Attach. 2 (Vieregge Mem. of Aug. 21, 2002) at 2. Shell estimates that 17,000-32,000 gallons of product remains trapped in soils at the Rand Avenue Leak location, northeast of the Village. Id.

-- whether the gasoline rushed along underground or slowly seeped through the fill -- he stated he was not sure how it would look underground. Butler Test. Day 13 at 85. When asked how the gasoline would change direction from flowing west, downhill, beneath Rand Avenue where a number of sewer lines and pipelines are laid, to south towards Cherry Street, and then east to 102 East Cherry Street, Dr. Butler acknowledged that he does not know what the path of the gasoline might have been.[17/] Butler Test. Day 13 at 86-88. Similarly, Dr. Butler acknowledged that he does not know the pathway by which the gasoline would have reached 119 West Date Street, which suffered a series of vapor intrusion events beginning in May 1990. Butler Test. Day 13 at 88-89.

Dr. Butler's opinion regarding a supposed relationship between the Rand Avenue Leak and the 1990 odor complaints and fires is nothing more than bald speculation. He simply brings no expertise and has performed no scientific analysis to support his assertion that a gasoline leak would have traveled hundreds of yards through subsurface soils -- the gravel and sand fill surrounding the pipelines, utility lines, and sewers -- diverging at least in part from the larger pipeline corridors traveling downhill beneath Rand Avenue to take 90 degree turns south into the Village and then additional 90-degree turns both east and west to arrive at certain affected homes in different portions of North Hartford.

[17/] Moreover, the evidence is uncertain at best as to whether gasoline was actually present in a sump at 102 East Cherry Street subsequent to the May 21, 1990 fire. Dr. Butler relies on a May 31, 1990 Illinois EPA memorandum that memorializes a conversation that occurred two months earlier, on March 27, when the Fire Chief apparently indicated that gasoline was found in a 38-inch deep sump on the southwest side of the house. Pl. Ex. 95; Butler Test. Day 13 at 79-80. On March 22, 1990, the day after the fire, an inspector conducted an "origin and cause" investigation on behalf of the homeowner's insurance company. See Pl. Ex. 140 at AR00386-394. The report includes a detailed room by room assessment of the home and makes no reference to a sump. Id. The report does note however that the inspector used a backhoe to excavate a three and one-half foot hole outside the south basement wall. Id. at AR00392. While the inspector noted that the soil "appeared to be saturated with gasoline," liquid gasoline was not present and was not collected. Id. at AR00392.

Dr. Butler attempts to buttress his opinion that the distant Rand Avenue Leak was a more likely source of the vapors that impacted Hartford homes in 1990 than the NAPL directly beneath those homes by asserting that the free-phase NAPL is separated from the residences by clay layers which serve as an "impermeable barrier" to vapor migration. Butler Test. Day 12 at 96. Dr. Butler, however, admitted that his "impermeable" clay layers had to be permeable to liquid hydrocarbons, since the free-phase NAPL beneath North Hartford was the result of spills and leaks of petroleum products in the near surface. Butler Test. Day 13 at 90. Moreover, the meaning of the term "impermeable" was clarified by Apex Oil's expert hydrogeologist, Manu Sharma:

> Q: So, "impermeable" means water couldn't get through, doesn't it? That's what a lay person like me understands it to mean.
>
> A: A lay person may understand it that way, but from a scientific standpoint, "impermeable" means it has a low permeability, but it doesn't mean zero.

Sharma Test. Day 14 at 114. On this topic, Dr. Butler's knowledge is that of a lay person. He lacks the expertise in geology to appropriately opine on the impact of silty-clay layers on vapor migration.

This lack of expertise was further illustrated by his attempt to use boring log notations to illustrate a lack of vapor-phase hydrocarbons in various soil strata. See Butler Test. Day 12 at 100-102. Soil borings are conducted in constructing monitoring wells. Technicians examine the soil cuttings generated by the boring and make notations regarding the soil constituents (sand, clay, etc.) at different depths and the presence of petroleum odors among other things. Dr. Butler asserted that his review of the boring logs showed few notations for petroleum odors in the upper silty-clay layers, from which he concluded vapor-phase hydrocarbons were not present

in such "impermeable" layers, and thus vapors from free-phase NAPL were not migrating from the Main Sand to basements located in the A Clay. Butler Test. Day 12 at 100-102.

The inaccuracy of Dr. Butler's assumption was illustrated at trial through a review of the boring logs generated in connection with installation of a soil vapor monitoring point on East Watkins Street (VMP 81). While the boring log for VMP 81 included notations of "strong petroleum odor" in the sand stratum 25-30 feet below ground surface ("bgs") and "slight petroleum odor" in the sand 20-25 feet bgs, no odor notations were included for the various strata above 20-feet bgs. See Pl. Ex. 177 at EPA_RPT001579-580; Butler Test. Day 13 at 113-117. Vapor samples collected at points within the "no odor" zone, however, contained significant concentrations of hydrocarbon vapor constituents. For example, samples collected on January 6, 2005 from the "shallow" monitoring point, located in a "no odor" clayey-silt layer 13-13.5 feet bgs, contained 350,000 ppbv benzene and 9.8 million ppbv isopentane. Pl. Ex. 177 at EPA_RPT001426. Likewise samples collected from the "very shallow" monitoring point, located in a "no odor" sandy-silt layer 3-3.5 feet bgs, contained 990 ppbv benzene and 860,000 ppbv isopentane. Id. Dr. Butler's assertion that the lack of odor notations in boring logs is indicative of an absence of vapor-phase hydrocarbons is simply inaccurate -- and, indeed, Dr. Butler conceded the point at trial. See Butler Test. Day 13 at 118.

Moreover, contrary to Dr. Butler's assertions regarding "impermeable" clay, soil vapor sampling conducted throughout North Hartford found extraordinarily high levels of vapor-phase hydrocarbon constituents in the A Clay, including isopentane levels of 100 million ug/m3 throughout much of the area and benzene levels of 1 million ug/m3 in a number of locations. See Pl. Ex. 177 at EPA_RPT001372-373; Butler Test. Day 13 at 97-99. Dr. Butler conceded under cross-examination that the benzene found in the A Clay may be related to benzene in the

North Olive and Main Sand strata at locations where the A Clay is in direct contact with those strata.[18] Butler Test. Day 13 at 100-102.

Dr. Butler's Opinion No. 6, that the 1990 odor complaints and fires are unrelated to the free-phase NAPL, should be struck as unreliable because he lacks the expertise to assert such an opinion.[19] Dr. Butler has admitted that he is unfamiliar with the specific transport mechanics that could theoretically have resulted in the Rand Avenue Leak impacting certain North Hartford homes. His assertions regarding the "impermeable" nature of the clay layers are demonstrably false and predicated upon a lack of knowledge as to the use of the term "impermeable" in the scientific community and an improper interpretation of boring logs. Opinion 6 is nothing more than unsupported speculation regarding the cause of the 1990 odor complaints and fires, let alone a sufficient basis from which to extrapolate that the ongoing hydrocarbon vapor issues in Hartford are unrelated to the free-phase hydrocarbon contamination present beneath much of North Hartford.

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[18] Dr. Butler likewise acknowledged that clay layers can contain sandy seams and fractures that present preferential pathways for vapor migration through those layers. Butler Test. Day 13 at 103-104. Fractures were identified in the A Clay in the vicinity of the Hartford Community Center during excavation of test pits there. Id. at 104-105.

[19] Dr. Butler opined that the increase in odor complaints / fires in Spring 1990, following a period of quiet, is indicative of the complaints being the result of a new vapor source (*i.e.* the Rand Avenue Leak). Butler Test. Day 12 at 91-92. The spate of complaints in 1990, however, is also consistent with the hypothesis that odor complaints / fires occur when groundwater levels are rising. From January 1988 through January 1990, drought conditions existed in the Hartford area and groundwater levels steadily declined. Butler Test. Day 13 at 73-74; Pl. Ex. 164 at APEX000808, 852-853. When groundwater levels began to rebound in the Spring of 1990, odor complaints and fires reoccurred as well.

Signature page for *United States Renewed Motion to Strike Testimony of Eric L. Butler* filed in United States v. Apex Oil Co., Inc., Case No. 05-CV-242 (S.D. Ill.).

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March 21, 2008

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CERTIFICATE OF SERVICE

I, Jeffrey A. Spector, an attorney, hereby certify that on March 21, 2008, I electronically filed *United States' Renewed Motion to Strike Testimony of Eric L. Butler* with the Clerk of the Court using the CM/ECF system which will send notification of such filing to the following,

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